

Appl No.: 10/655,986
Reply to Office Action of May 17, 2006

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REMARKS/ARGUMENTS

Favorable consideration of this application is respectfully requested. Applicant has amended the independent claims 1, 21, 25, 29 and dependent claim 30. Dependent claims 7 and 22 are cancelled because they are now incorporated in the relevant independent claims. Claims 8-20 are cancelled because of a restriction requirement. Claims 1-6, 21, 23-30 are now pending. No new matter has been entered. Favorable reconsideration is earnestly solicited in view of the following remarks.

In paragraph 1 under the heading "**Election/Restrictions**" of the Office Action of May 17, 2006, the Examiner argues in support of the Restriction requirement based on finding two distinct inventions: I- (Claims 1-7 and 21-30), drawn to monodispersed, spherical ZrO₂ particles and powder; II- (Claims 8-20), drawn to methods for producing monodispersed, spherical ZrO₂ particles and powder.

Applicant responded to the restriction requirement on April 10, 2006; Applicant has elected to prosecute the invention of Group I, claims 1-7 and 21-30, with traverse. Applicant reserves the right to file a divisional application for the non-elected invention in Group II, Claims 8-20.

Referring now to each of the Examiner's objections beginning on page 2, a second paragraph 1 under the heading "**Claims Rejections – 35 USC § 102**", of the Office Action of May 17, 2006, Applicant has amended the claims to clearly identify and claim the inventive features of Applicant's invention and thereby distinguish the present invention from each of the references, or combination of references, cited by the Examiner. No cited reference, individually, or in combination with other references, teaches or suggests that a sol-gel process could be used to produce monodispersed, spherical zirconia (ZrO₂) particles of approximately 10 to approximately

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600 nm, that are pure and free of foreign oxides and exhibit metastable tetragonal crystal structure at room temperature, and said particles are suitable for forming durable coatings on metallic and ceramic substrates.

Applicant now addresses each rejection in the numerical sequence of each paragraph in the Office Action.

Claim Rejections under 35 U.S.C. §102(b)

On page 2, in paragraph 2, of the Office Action of May 17, 2006, Claims 1-2, 4-5, 7, 25-27 are rejected under 35 U.S.C. 102(b) as being anticipated by Atita (U.S. Pat. 5,472,795). The Examiner argues in paragraph 3 that Atita teaches a nanolaminate of zirconium oxide containing a thin layer of polycrystalline metastable tetragonal zirconia deposited on a support. The Examiner further argues that the crystalline particles of Atita are "inherently spherical." Thus begins a flawed argument because crystals or crystalline shapes are not inherently spherical and it requires a special technique to achieve the spherical particles as claimed by Applicant. In the paragraph bridging columns 3 and 4, Atita (U.S. Pat. 5,472,795) describes the zirconia layers as . . . "polycrystalline, i.e., . . . made up of a multitude of closely packed crystallites . . ." This structure is quite dissimilar than that of Applicant's spherical, monodispersed particles..

Claims 1-2, 4-5, 25-27 are now amended and/or dependent on an amended Claim to further distinguish the (ZrO₂) particles of Applicant as being synthesized using a sol-gel technique and being pure and free of foreign oxides. [Underlining for emphasis] Support for this amendment is found in original claim 7; original claim 22; page 4, lines 1-3; page 5, lines 5-10; page 15, lines 9-14. No new matter has been added by the amendments to the Claims 1 and 25.

Atita teaches that "a process for making a nanolaminate material of the invention is carried out by sputter deposition" (col. 2, lines 18-19). In contrast, Applicant uses a sol-gel technique for

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making the monodispersed, spherical zirconia (ZrO_2) particles of the present invention.

[*Underlining for emphasis.*] There is no suggestion or teaching in Atita that a sol-gel process or technique could be used to make monodispersed spherical zirconia (ZrO_2) particles.

In view of the above, Applicant respectfully requests the withdrawal of the rejection of Claims 1-2, 4-5, 25-27 under 35 U.S.C. 102(b) as being anticipated by Atita (U.S. Pat. 5,472,795). Likewise, for Claim 7 which is now canceled since it has been incorporated in the independent claim 1, the rejection under 35 U.S.C. 102(b) as being anticipated by Atita (U.S. Pat. 5,472,795) is considered moot and it is respectfully requested that the rejection be withdrawn.

In paragraph 4 of the Office Action of May 17, 2006, Claims 1, 3-4, 6, 29 are rejected under 35 U.S.C. 102(b) as being anticipated by Montino (U.S. Pat. 5,002,909). The Examiner argues in paragraph 5 of the Office Action that Montino teaches spherical particles of mixed oxides of alumina and zirconia, stabilized at room temperature in a crystalline tetragonal phase, consisting essentially of non-agglomerated particles in a particle size from 0.1 to 1 micrometer.

Applicant has amended independent Claims 1 and 29 and, indirectly, the dependent claims 3-4 and 6, to emphasize that zirconia (ZrO_2) particles are prepared by a sol-gel technique and are pure and free of foreign oxides. Support for these amendments is found in original claim 7; original claim 22; page 4, lines 1-3; page 5, lines 5-10; page 15, lines 9-14. No new matter has been added by the amendments to Claims 1 and 29. In contrast to Applicant's invention, Montino teaches the preparation of mixed oxides unlike Applicant's pure oxides, free of foreign oxides.

Further, Montino teaches and claims that the mixed oxides of alumina and zirconia are obtained by subjecting the amorphous hydrated mixed oxides to thermal treatment; this is clearly unlike Applicant's sol-gel technique for forming monodispersed, spherical zirconia particles that

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are pure and free of foreign oxides. There is no suggestion from Montino that Applicant's sol-gel technique could produce the products claimed herein.

Applicant respectfully requests the withdrawal of the rejection of Claims 1, 3-4, 6, 29 under 35 U.S.C. 102(b) as being anticipated by Montino (U.S. Pat. 5,002,909) in view of the amendments and discussion above.

Claim Rejections under 35 USC §103(a):

Claims 21-23, and 25-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Atita (U.S. Pat. 5,472,795) in view of Allen (U.S. Pat. 6,652,987) in paragraph 7 of the Office Action of May 17, 2006. The Examiner argues that Atita *supra* is silent as to the presence of a metal substrate; however, Atita does teach that the substrate can be virtually any desired material (paragraph 8) while Allen *supra* teaches that it is known to use tetragonal zirconium oxide thermal barrier coatings on metals for reducing radiation heat transfer, etc. (paragraph 9). There is no suggestion or teaching that zirconia (ZrO₂) particles prepared by a sol-gel process that are *pure and free of foreign oxides* could be formed, as disclosed by Applicant and used for coating a metal substrate.

Further distinctions between Allen's patent and Applicant's invention are the teachings with regard to stabilizing the tetragonal (ZrO₂) particles. Allen *supra* at column 1, lines 30-33 states: "Yttrium, magnesium, calcium and/or other suitable oxide is typically added to the zirconium oxide to stabilize the tetragonal and/or cubic crystal structure required for coating durability." This teaches away from Applicant's invention. It was not known, nor envisioned that spherical (ZrO₂) particles could be prepared by a sol-gel process *pure and free of foreign oxides* exhibiting a metastable tetragonal crystal structure at room temperature and suitable for forming

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durable coatings. In contrast, Allen uses and teaches (ZrO_2) particles stabilized with other oxides for coating durability.

Applicant provides a significant advance in the art by providing (ZrO_2) particles prepared by a sol-gel process that are pure and free of foreign oxides and useful for providing durable coatings to metal substrates and ceramic substrates.

Applicant respectfully disagrees with the Examiner's argument in paragraph 10, that "It would have been obvious to one of ordinary skill in the art at the time of the invention to put the coating of Atita on a metal substrate" because "... it is known to use a tetragonal zirconium oxide thermal barrier coating on metal substrates . . ." as taught by Allen.

First, Applicant has amended the claims to distinguish Applicant's zirconia particles from those of Atita. Applicant has monodispersed, spherical particles formed by a sol-gel technique; in contrast, Atita has polycrystalline particles formed by sputter deposition. Thus, the cited art (Atita) reveals zirconia particles of a different shape produced by a different process while Allen teaches that for coating durability the zirconia particles have added oxides to stabilize the tetragonal and/or cubic structure. Neither reference individually, or in combination teaches or suggests zirconia (ZrO_2) particles prepared by a sol-gel technique, pure and free of foreign oxides exhibiting a metastable tetragonal crystal structure at room temperature making them suitable for durable coatings on metallic and ceramic substrates.

In view of the amendments to claims and discussion above, Applicant respectfully requests the withdrawal of the rejections of Claims 21, 23, and 25-27 under 35 U.S.C. 103(a) as being unpatentable over Atita (U.S. Pat. 5,472,795) in view of Allen (U.S. Pat. 6,652,987). Likewise, for Claim 22 which is now canceled, since it has been incorporated in the independent claim 21, the rejection under 35 U.S.C. 103(a) as being unpatentable over Atita (U.S. Pat. 5,472,795) in

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view of Allen (U.S. Pat. 6,652,987) is considered moot; it is respectfully requested that the rejection of Claim 22 be withdrawn.

In paragraph 11 of the Office Action of May 17, 2006, Claims 1, 3-4, 6, 21-22, 24-26, 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leushake (U.S. Pat. 6,168,833 B1) in view of Allen (U.S. Pat. 6,652,987). The Examiner argues (in paragraph 12) that Leushake teaches a coating process used in coating ceramic layers (metal) internal combustion or turbine engines. In creating a coating the process first creates monodispersed, (free of other oxides) unstabilized zirconium oxide powder or particles. . ." [Underlining and italics for emphasis.] The Examiner admits that the "reference is silent as to the zirconium oxide being in tetragonal phase." The distinctions between Leushake's invention and Applicant's invention are blatantly obvious in that Applicant uses a sol-gel technique to produce stable zirconium oxide particles in the very desirable tetragonal phase that are suitable for durable coatings on metal and ceramic substrates.

Further arguments for the combination of Leushake in view of Allen are made in paragraph 13, when the Examiner states that "Allen teaches that it is known in the art to use tetragonal zirconium oxide thermal barrier coatings on metals. . ." As stated above, the entire teachings of Allen include the requirement that zirconium oxide be stabilized to the tetragonal and/or cubic crystal structure with other oxides for coating durability. What was not known was that a person of skill in the art could prepare zirconium oxide particles using a sol-gel process and prepare monodispersed, spherical particles exhibiting metastable tetragonal crystal structure at room temperature.

Applicant refutes the Examiner's argument (in paragraph 14) that "It would have been obvious to one of ordinary skill in the art at the time of the invention to use the coating of Leushake with tetragonal zirconia because it is known to use a tetragonal zirconium oxide thermal

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barrier coating metal substrates because, at the time of the invention, it was not known to use a sol-gel technique to produce monodispersed, spherical, metastable tetragonal zirconium oxide at room temperature.

The Examiner has essentially used Applicant's invention as the basis for citing and combining two references to reject Applicant's invention under U.S.C. 103(a). It will be pointed out below that each of the cited references is significantly different than Applicant's invention and the combination of such references is impermissible under well established case law, to defeat the patentability of the invention being examined. In *In re Rouffet*, 47 USPQ 2d 1453, at 1457-1458 (Fed. Cir. 1998), the Court said "[I]o prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the examiner to show a motivation to combine the references that create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed." No motivation for the combination of these references has been shown absent Applicant's invention.

In view of the amendments to independent claims and arguments presented above, Applicant respectfully requests the withdrawal of the rejection of Claims 1, 3-4, 6, 21, 24-26, 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leushake (U.S. Pat. 6,168,833 B1) in view of Allen (U.S. Pat. 6,652,987). The rejection of cancelled Claim 22 is now moot; accordingly, Applicant respectfully requests the withdrawal of the rejection.

The application and claims are believed to be in condition for allowance in their amended form; allowance of Claims 1-6, 21, 23-30 is respectfully requested. If the Examiner believes that

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an interview would be helpful, the Examiner is requested to contact the attorney at the below listed number.

Respectfully submitted,



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